

DOCUMENT RESUME

ED 299 932

HE 021 936

TITLE An Engineering Student's Guide to the Humanities & Social Sciences.

INSTITUTION Association of American Colleges, Washington, D.C.

SPONS AGENCY Andrew W. Mellon Foundation, New York, N.Y.

REPORT NO ISBN-0-911696-43-1

PUB DATE Sep 88

NOTE 32p.

AVAILABLE FROM Association of American Colleges, 1818 R Street, N.W., Washington, DC 20009 (\$7.00).

PUB TYPE Guides - Classroom Use - Materials (For Learner) (051) -- Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.

DESCRIPTORS College Curriculum; *Course Selection (Students); *Degree Requirements; *Educational Planning; Elective Courses; *Engineering Education; Higher Education; Humanities; Liberal Arts; Social Sciences; *Undergraduate Study

IDENTIFIERS *Curriculum Balance

ABSTRACT

Undergraduate engineering students and their advisors are provided with a handbook to help improve the quality and coherence of the humanities and social sciences (H&SS) component of undergraduate engineering education (fostering more purposeful H&SS course selection). The first of this handbook's three sections has an engineering major and his advisor discussing the value of H&SS coursework and the case for taking it seriously. The second section is a brief set of general guidelines for constructing a sound H&SS component (noting it should do such things as fulfill the institution's and program's requirements, contribute to a general education, and include integrative and capstone experiences). Section three consists of eight sample H&SS clusters that illustrate how the guidelines can be applied by students with different needs, interests, and aspirations. The suggested cluster approach to H&SS course selection was designed by the project advisory committee and a working group of engineering and liberal arts educators from across the country. Suggestions about the H&SS component (as conforming to the Accreditation Board for Engineering and Technology guidelines) are that the H&SS component should be at least 12.5% of the student's total program, be planned to reflect a rationale or fulfill an objective appropriate to the engineering profession, include some courses at an advanced level rather than be limited to a selection of unrelated introductory courses. (SM)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

ED 299932

AN ENGINEERING STUDENT'S GUIDE



TO THE HUMANITIES & SOCIAL SCIENCES

"PERMISSION TO REPRODUCE THIS
MATERIAL IN MICROFICHE ONLY
HAS BEEN GRANTED BY

Association of
American Colleges

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☒ This document has been reproduced as
received from the person or organization
originating it.

☐ Minor changes have been made to improve
reproduction quality.

• Points of view or opinions stated in this docu-
ment do not necessarily represent official
OERI position or policy.

ASSOCIATION OF AMERICAN COLLEGES

956 120 341

AN ENGINEERING
STUDENT'S GUIDE
TO THE
HUMANITIES &
SOCIAL SCIENCES

ASSOCIATION
of AMERICAN
COLLEGES

THIS WORK WAS SUPPORTED
BY THE ANDREW W. MELLON FOUNDATION

COVER: An engineering survey team, with a theodolite, atop Monte Leone on the Swiss-Italian border, the center of triangulation operations for the planning of the Simplon Tunnel under the Alps (1906). Courtesy of Mary Evans Picture Library, London.

This handbook features illustrations of a number of important developments from the history of technology. They remind us that the origins and effects of technology are best understood in human and social terms.

For all captions, the author is indebted to four sources: James Burke, *Connections* (Little, Brown and Company, 1978); Robert O'Brien, *Machines* (Time, Inc., 1964); Ronald W. Clark, *Works of Man* (Viking, 1985); Derek Birdsall and Carlo M. Cipolla, *The Technology of Man* (Penshurst Press, 1979).

Student and advisor photographs by J. Tyler Campbell
Artwork on pages 4, 6, 8, 9, 11, 16, 20, 23, 24, 26: The Bettmann Archive, New York
Artwork on page 12: M.638 f. 23v., The Pierpont Morgan Library, New York
Photograph on page 14: Pennsylvania State University
Photograph on page 18: Worcester Polytechnic Institute

PUBLISHED BY THE ASSOCIATION OF AMERICAN COLLEGES
1818 R STREET, NW; WASHINGTON, DC. 20009

COPYRIGHT 1988 ISBN 0-911696-43-1

TO THE ADVISOR

THIS HANDBOOK is intended for use by undergraduate engineering students and their advisors. One product of a three-year effort by the Association of American Colleges (AAC) to improve the quality and coherence of the humanities and social sciences ("H&SS") component of undergraduate engineering education, it has been designed to foster more purposeful H&SS course selection. The handbook has been prepared with generous support from the Andrew W. Mellon Foundation, and with the cooperation of the Accreditation Board for Engineering and Technology (ABET), the nationally recognized accrediting agency for engineering programs.

The handbook has three sections. In the first, an engineering major and his advisor discuss the value of H&SS coursework and the case for taking it seriously. The second section is a brief set of general guidelines for constructing a sound H&SS component. The third and final section consists of eight sample H&SS components, or "clusters," that illustrate how the guidelines can be applied by students with different needs, interests, and aspirations.

The "cluster" approach to H&SS course selection suggested in these pages was designed by the project ad-

visory committee and a working group of engineering and liberal arts educators from across the country. What a given undergraduate engineering student can do with the H&SS requirement depends largely on where he or she is enrolled. Some institutions—indeed some engineering programs—have carefully spelled out requirements for such coursework. The challenge taken up by AAC and its advisors, however, has been to propose an approach that would be helpful in more typical settings. Data strongly suggest that typical settings are those that provide only a loose framework of H&SS requirements. They allow engineering students great discretion in H&SS but give them little of the guidance they need in order to use their freedom well. The result, typically, is course-taking that might best be described as episodic, and that in its incoherence fulfills few of the proper purposes of H&SS study.

What exactly is meant here by the terms "humanities" and "social sciences?" For ABET's purposes and ours, a humanities or social sciences—or H&SS—course is one within the broad areas of the humanities (including foreign languages and certain nonperforming or nonstudio-based fine arts courses) or the social sciences. This definition encompasses

such fields of study as (in the humanities) history, English, philosophy, foreign languages, classics, history of religion, history of music, and history of art; and (in the social sciences) sociology, psychology, economics, anthropology, and political science. The particular fields offered within the two areas of study may, of course, differ from school to school. As defined by ABET, an H&SS course can also be one that combines the perspectives of engineering with one or both of these. ABET does not accept for H&SS credit courses in a business discipline or in military training, or any course designed primarily to impart skills—for example, in written or oral communication.

The suggestions that follow all conform to these ABET guidelines, as well as to three others: that the H&SS component be *at least* 12.5 percent—about one semester's worth, or sixteen credit hours—of the student's total program; that it be "planned to reflect a rationale or fulfill an objective appropriate to the engineering profession"; and that it "include some courses at an advanced level rather than be limited to a selection of unrelated introductory courses."*

* Criteria for Accrediting Programs in Engineering in the United States: Effective for Evaluations During 1986-87 Academic Year (New York: Accreditation Board for Engineering and Technology, 1986).



A CONVERSATION

WHY ARE the humanities and social sciences ("H&SS") important to engineers? Why should engineering majors think carefully about their H&SS course selections? A conversation between an engineering major and his advisor suggests some answers.

STUDENT: Thermodynamics at 10:30 Tuesdays and Thursdays, Chemistry II at noon, then Differential Equations at 2:00. Tight schedule! But that's it, I guess.

ADVISOR: Except for...

STUDENT: Oh...the humanities and social sciences requirement.

ADVISOR: What would you like to take?

STUDENT: What H&SS courses? I don't know. My roommate aced a history of theater course last semester. He says it was boring, though. I hear the psych department offers something that meets just after my design

seminar gets out. That would be convenient. Or I could take another intro course, like microeconomics. At least that might be useful someday.

ADVISOR: Don't you think you should have more of a plan?

STUDENT: Maybe. But the rest of my courses have already been so mapped out there's almost nothing I can change. That's one good thing about the H&SS courses. I've got some freedom of choice with them.

ADVISOR: It seems to me, though, that you could use that freedom more to your advantage. You have to take a certain number of H&SS courses, right? Why not select them with some care so they'll have value to you?

STUDENT: I don't know...

ADVISOR: Look, we've spent a fair amount of time in these conferences the last couple of years. Suppose you give me a few more minutes.

I'm opening the door to one of those 'value of the liberal arts' talks, aren't I?



STUDENT: Well...if you think you can save me from the theater course.

ADVISOR: You know, you're like most undergraduates in engineering these days. You're bright, you're hard-working, you've got good prospects for a career. You're also very, very focused. What with the competition for jobs, the tough courses in some pretty specialized areas, you have to

be. Still, you're not getting as broad an education in the humanities and social sciences and fine arts as some others are. Maybe even as broad an

education as you'd like to get.

STUDENT: I guess I did do more things in high school. I took all sorts of courses. And I still have other in-



It's easy to neglect H&SS courses because there are so few of them. But when you do that you're wasting a limited opportunity.

terests. But you're right. There's not a lot of time now for anything but math, science, and engineering.

ADVISOR: But there is some time—the time set aside for H&SS.

STUDENT: So what do you suggest I do with it?

ADVISOR: I can't tell you what courses to take. But I can encourage you to give more thought to your own selections. It's easy for engineering students to neglect their H&SS courses because there are so few of them. But when you do that you're wasting a limited opportunity. This is

As far back as paleolithic times, humankind has shown itself to be, in Benjamin Franklin's phrase, a "tool-making animal." Archeologists actually date the emergence of humans from the first ap-

pearance of stone tools, the earliest of which, from the Omo Valley in Ethiopia, are an estimated 2.51 million years old. Pictured here from a cave painting is

a buffalo hunt, conducted with spears tipped with patiently chipped stone spearheads. These implements are primi-

tive or proto-machines, simple devices for applying human strength more effectively.



your chance to pursue and to develop your interests and to pick up some things—whole areas of knowledge and ways of thinking—that your engineering courses won't provide you. Things that can be important to you down the line.

STUDENT: Important? I'm opening the door to one of those "value of the liberal arts" talks, aren't I?

ADVISOR: You mean: "H&SS courses will help make you a better person, a better family member, and a better citizen. Maybe even a more interesting person to yourself"? Well, the only problem I have with that is that it makes H&SS sound like medicine, and you like the reluctant patient. Actually, the thing itself—well, it's discovering the Impressionists and da Vinci and critiquing American foreign policy during the Vietnam War. It's learning about the Harlem Renaissance and Greek philosophy, schizophrenia, Islam, and Keynesian economics. It might include learning a language—Spanish, Swahili, Japanese—or the politics of getting a bill through Congress. H&SS covers an enormous territory—the human experience.

STUDENT: So you're saying it can be really interesting.

ADVISOR: And—it's true—do you some good. You know, colleges and universities have a term: "general education." The idea is that there are experiences and abilities and knowledge that every college student should

acquire, no matter what he or she majors in or intends to do as a career. These experiences—these kinds of knowledge—enrich our lives. They help us fulfill our promise as human beings. They make us better fathers, mothers, colleagues, and friends. They make us informed about our country and the world. Really, it's the "major" that complements "general education" with more specialized training, not the other way around.

STUDENT: What kinds of "experiences and abilities, and...?"

ADVISOR: Skills in different forms of thinking. Experience with writing, reading, and speaking. Understanding numerical data. Historical consciousness. A basic grasp of science. A sense of values. Some experience with the fine arts. Exposure to other cultures... Now, you're having some of these essential experiences as you complete your program in mathematics, the natural sciences, and engineering.

STUDENT: Still, for others—most of the others—I'd have to look to the humanities and social sciences, right?

ADVISOR: That's right. So—the notion of *general education* is pretty simple. You're a human being first, an engineer second.

STUDENT: Okay. Maybe general education makes sense. And maybe it does have a place in my program. In anyone's. But realistically, I came to college mostly so I could learn to be



Most business activities must be performed by individuals trained in finance, engineering, accounting, and so on. But those people do not perform in a vacuum. It is up to their managers to motivate them and coordinate their efforts in ways that maximize personal satisfaction and achieve the organization's goals. And they, as managers, must do the same for the people who work for and with them. Thus, the practice of management art and the pursuit of business excellence call for an entirely different, but parallel, set of non-technical skills—skills that we urgently need today. These abilities can readily be acquired through liberal arts training.

Roger B. Smith
Chairman
General Motors
Corporation



Greek society depended heavily on technology to manufacture the exports of metal and metalwork, cloth, pottery, oil, and wine for which imports of food and luxuries were exchanged. One Greek, Eupalinos, who is sometimes called the first civil engineer, built a

famous water-supply tunnel on Samos in the sixth century B.C. The unprecedented beauty of the contrasting black and red colors of Greek pottery, derived from newly discovered chemical processes, and the production of these artifacts marks one origin of the science of ceramics.

a good engineer. That's why I'm here. And that has to be my first priority.

ADVISOR: You shouldn't assume that something that's worth doing for other reasons doesn't also have practical value to your career. The fact is that H&SS coursework actually can help make you a better engineer.

STUDENT: How?

ADVISOR: In several ways. Look, the benefits of H&SS coursework can be oversold—like anything else. Not all H&SS courses are well taught, and they aren't necessarily any more “liberal” in spirit or broad in their reference than engineering courses. But traditionally, the humanities and social sciences have been found to broaden students' educations—

The humanities and social sciences probably are 'broader' than just science or engineering—but they seem 'softer,' too.



whatever their majors—in ways that enhance and extend specifically technical training.

STUDENT: “Traditionally.” But maybe these days...

ADVISOR: For today's engineering undergraduates, the chances are even greater that an investment of time in some carefully selected H&SS courses will pay professional dividends.

STUDENT: I don't understand.

ADVISOR: What is the biggest challenge your generation of engineers will have to face? Probably change itself. It's going to be a given throughout your career. You've prob-

But H&SS courses often tackle issues that engineering approaches aren't any help with.



ably heard the scenario. The world will continue "shrinking" as countries become increasingly interdependent economically and as business and industry—and engineering—internationalize. There will be fundamental demographic changes—in the workplace and outside it. Political and cultural upheavals; new social and professional roles; new legal, regulatory, and societal expectations. New scientific breakthroughs. The reaching of technology into every corner of our lives. Product lines, markets, and, in many cases, whole industries—they'll emerge, prosper, and then decline as new ones take their place. In a word, *change*. It's going to be constant and increasingly rapid.

Engineers will have a big part in creating that change. That's part of the excitement of the profession. But you'll have to cope with it, too. Consider technological change. Already, they say, about half of an engineer's specific technical knowledge becomes obsolete every five years. You'll need to work hard to stay abreast of things and be flexible enough to adapt—especially to adapt creatively—to all the changing demands. You'll probably change engineering jobs a number of times and—over the full course of your working life—possibly even your career.

STUDENT: Really? And you think H&SS courses can help me handle all that?!

ADVISOR: Good H&SS courses can foster the kind of flexibility you'll be needing, yes. They can develop the whole set of mental habits that make a person flexible: curiosity, skepticism, independence of mind, reflectiveness. And abilities—like asking questions, framing issues, and using different kinds of evidence. People steeped in these fields often seem a little more comfortable with ambiguity, and because they've learned to look at things from various perspectives, they tend to see things in context...see the big picture. It's all part of what equips you for handling change, for operating in different settings. A broad foundation of thinking skills that never go out of date, that can be used again and again. Someone once said, only half-jokingly, a really good education is what you have left when you've had to forget everything you've learned.

STUDENT: Well, the humanities and social sciences probably are "broader" than just science or engineering—but they seem "softer," too. I mean, from what I've seen of them, there don't seem to be many right answers. Things seem so often to be matters of opinion—to depend on what you believe.

ADVISOR: A lot of engineering students feel that way, partly because they're predisposed and trained to deal with quantitative information and problems. But H&SS courses often tackle issues that engineering



It seems to me that anyone who would call himself college-educated—particularly anyone who would call himself a professional—should spend some time in close communion with the great souls, the great thinkers, the great artists, of our civilization. Most particularly, those engineers who would be leaders—those who would participate in the important communal debates—should be acquainted with the thoughts, theories, and philosophies that constitute the foundations of our culture.

Samuel C. Florman
Vice President
Kreisker Borg Florman
Construction
Company

You're saying that with the abilities I can pick up in the humanities and social sciences, I would be better off than with...



If you make good use of your H&SS courses, you can develop a broader intellectual foundation.

approaches aren't any help with, that largely don't lend themselves to quantification and that may have no clear-cut answers. All the same, these are problems that are difficult, important, and often very real-world. So the courses bring different, more appropriate approaches to bear on them. But different doesn't mean not as good. Rigor, high standards—they are as valued in the liberal arts as in engineering.

STUDENT: It almost sounds like you're saying that with the abilities I can pick up in the humanities and

social sciences, I would be better off than with...

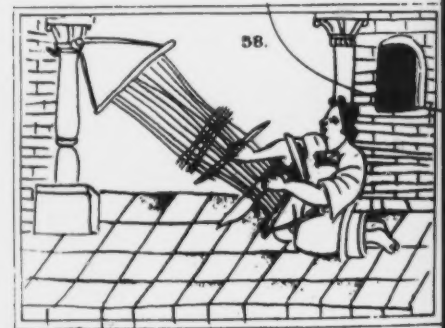
ADVISOR: ...only better off than you would be without them. It's not a question of "either...or." You can—you will—have your technical training. But if you make good use of your H&SS courses, you can develop an even broader and more basic intellectual foundation, too, that will serve you well as an individual and as an engineer.

STUDENT: I...sort of understand. But "seeing things in context," "framing issues"—it's pretty abstract. Can

How did the ancient technology of the loom, shown in this woodcut of an Aztec weaver, figure in the development of computers? The seventeenth century saw the invention of a number of hand-powered calculating devices—rods, slide rules, and machines (the one shown on the opposite page was devised

by the French mathematician Blaise Pascal in 1642). Not until the 1880s, however, was an electronic calculating device conceived by a young American engineer, Herman Hollerith. His tabulator, employed with great success in the 1890 census, used punch cards for recording data. This

method had been pioneered in about 1804 by a French silk weaver, Joseph Marie Jacquard. Using punch cards to "communicate" a pattern to his loom, Jacquard had hit upon the binary code, the "yes or no" language system spoken by today's computers.



you give me an example of what you're talking about—how this kind of thing is really relevant in engineering?

ADVISOR: Well...a quick historical one. You know, there was a point at which development of the internal combustion engine moved toward higher compression ratios. The idea was to develop greater power from smaller engines. This was a change that required some new thinking. Specifically, someone needed to design fuels that would tolerate higher compression, and the temperature extremes it causes, without igniting prematurely. Adding tetraethyl lead to gasoline solved the immediate problem but created a new one. The lead remaining in the engine's cylinders eventually produced severe fouling.

The engineers involved conceived

of the problem as one of clearing the lead from the engine. So they added ethylene dibromide to the gasoline. That, at ignition, produced gaseous lead bromide that could be eliminated with the other gaseous products of combustion.

Now it seems to a lot of people that this "solution" wasn't really adequate. Because, as a consequence, for years afterward in high traffic areas the major constituent of air (beyond its normal chemical composition) was *lead*! Since about 1940, there's been a tremendous increase in environmental lead everywhere. It's evident even in the snow pack in Greenland. And it's very hazardous stuff.

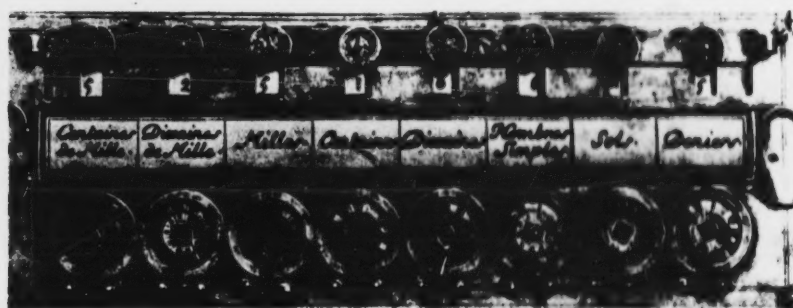
STUDENT: And you think more H&SS courses would have helped?

ADVISOR: Well, suppose those involved had conceived the design challenge more broadly, not drawing



What we need to incorporate in our curricula is... more liberal education, a fundamental change from the recent trend toward increasing specialization. We engineers are among the worst of the offenders, because we usually start narrowing our focus around the age of fourteen. The challenge to the student is to secure specialized knowledge at increasing levels of sophistication and—at the same time—to broaden the scope of learning... In the future, it won't be enough to know a lot, because many more people in the world are being educated and trained and know a lot... Success will go to the modern-day equivalent of the classical renaissance person—well-versed in many arts and sciences.

James M. Trice, Jr.
Manager
Marketing Recruiting
& Development
Monsanto Chemical
Company



a boundary line around the engine itself but giving more thought to the world—the environment—in which the engine functions. Suppose there had been more reflection, more healthy skepticism and concern with the contexts and consequences of the technology. The problem might have been framed more broadly—not “how can we do this?” but “how can we do this with no harm to the environment or to human health?” These are the kinds of perspectives H&SS study fosters, and in this case, they would have made for better engineering.

So you're saying engineers need to think about engineering in more and different ways.



STUDENT: So you're saying engineers need to think about engineering in more and different ways.

ADVISOR: Especially since the questions they confront are becoming so complex.

How do you balance cost against reliability in an infant heart monitor? How do you make a decision like the one the engineers and managers in charge of the Challenger had to make?

STUDENT: I see in an overall way what you mean. It would be good if engineers were more liberally educated. But I have some hard, individual choices to make about how and where I'm going to spend my time. And I have to be practical. So I wonder, if I have a strong background in H&SS, are engineers going to see that as in my favor? Will it



Especially since the questions they confront are becoming so complex.

help me get a better job?

ADVISOR: You need to distinguish between finding your first job and pursuing your career. There are some employers who look for broad academic experience when they hire entry-level engineers. But the chances are that your study of a language, or the American novel, or comparative political systems—or even professional ethics—won't help you much in landing that first position.

STUDENT: I didn't think so.

ADVISOR: Over time, though, the benefits of studying the humanities and social sciences will begin more and more to “kick in” and make a difference. Even in a first job, you may have to deal with issues that, though they're practical, transcend engineering science. For example, what problems are to be solved, how specifications are to be written, what materials and energy sources are to be used. And good engineering design at any level can draw on what someone has called a “disciplined creativity”—the kind of thing that comes of having an imagination and an aesthetic sense exercised and nourished by the humanities and the arts.

STUDENT: But over time, you say. . .

ADVISOR: It's over time that a broad education *really* pays off. It provides an excellent base for professional growth. The further along engineers move in their careers, the more likely they are to need the skills and abilities associated with the humanities and social sciences, and the less likely they are to draw on specific technical skills, especially those learned in school. They become supervisors—a role in which they need to be able to synthesize, see things whole, and deal effectively with people. They are called upon more and more to communicate, clearly and persuasively, in directing

The Greek scholar Ptolemy first described in the second century B.C. an instrument for measuring the position of the sun, moon, and stars. Lost for centuries after the destruction of the great library of Alexandria, one copy of the text describing this instrument, the astrolabe, survived and was discovered by the Arabs in the eighth century. It became the astronomer's basic tool for seven hundred years.



As an investment banker with a focus on emerging growth companies in the biotechnology field, I draw in obvious ways on my technical training—an undergraduate background in engineering and graduate work in both biology and finance. But I've also found there's no skill more valuable in business than an ability to work with people—to understand and respond to their needs and concerns and wants, and to communicate *your* ideas to them not only clearly but in ways that generate some interest and excitement. It's one thing—an important thing—to know how to crunch the numbers. It's another

Russell T. Ray
Vice President
Alexander Brown,
Incorporated



to lead a team, manage a project, exercise judgment—the kind of thing you need to do to move ahead in most fields. The humanities and social sciences can help lay a good foundation for these other kinds of skills. That's not the only reason for studying them—but it's one good one.

project teams or making presentations to clients. The broader their responsibilities, the more likely it is that they'll need to explain their work to nonengineers—consumers, legislators, judges, bureaucrats, environmentalists, and members of the press—in order simply to get their jobs done.

I heard about a study that found that two-thirds of engineers spend at least two-thirds of their time on management.



are now also social problems—or ethical, or political or international problems—that some ability

And to do that they need not only to speak and write effectively, but genuinely to understand non-engineering perspectives. So many technical problems



So many technical problems are also social problems that to deal with them is just a part of the essential professional equipment of engineers.

to deal with them as such is just part of the essential professional equipment of engineers.

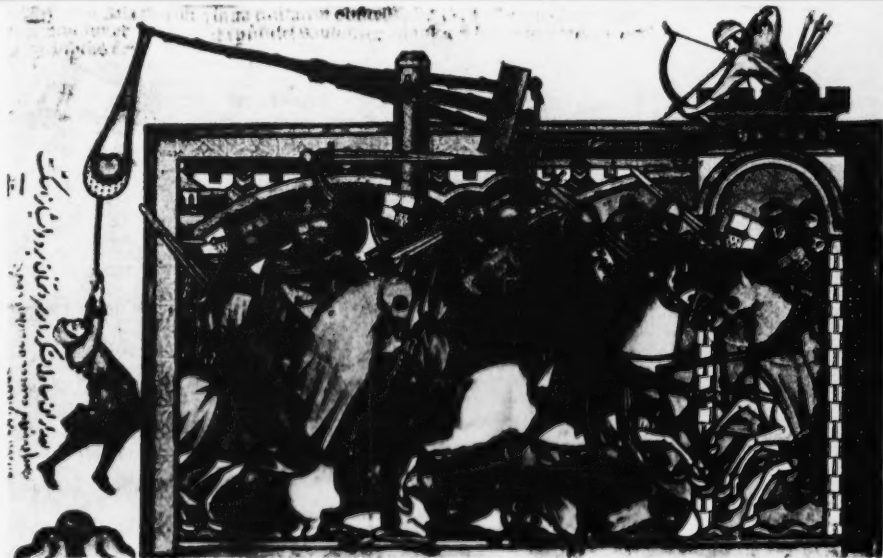
STUDENT: I heard about a study that found that two-thirds of engineers spend at least two-thirds of their time on management.

ADVISOR: And you have aspirations to become a manager?

STUDENT: I have a lot of student loans to pay off. . .

Anachronistically, this thirteenth century French manuscript features medieval modes of warfare. The illumination depicts Saul's triumph over Nahash and the Ammonites (I Samuel) and features not only mounted, helmeted knights in chain mail armor, but the latest in heavy weaponry—the counterpoint-powered trebuchet. Developed in the twelfth cen-

tury, the trebuchet supplanted torsion and tension artillery. Here a biblical artillery man pulls down the sling of the weapon for an assault on an enemy parapet. After securing the trebuchet's sling with catches, he would have weighted the three ropes to the right of the parapet. Once the catches were sprung, the weights hurled the stone.



ADVISOR: Well, what you've heard is true. It's also true that too many engineers reach a point when they are moved into management only to find that they lack the skills—especially the “people” and communication skills—to be effective there. That's unfortunate for them, since management often represents their only route for further advancement. And it's a concern of the whole profession.

But it's misleading to focus on that group. It's a more general thing, this tendency of engineers to value H&SS courses as their responsibilities expand. Over the years, a number of colleges and universities—schools like Purdue and Harvey Mudd—have asked their engineering alumni in what areas they wish they had taken more courses as undergraduates. Engineers who have just graduated tend to cite technical subjects. Graduates ten years out of school mention business and social sciences courses like economics and psychology. And those twenty years or more out of school (in their mid-forties or older, just reaching the height of their careers) regret most not having studied the humanities—literature, history, and philosophy.

STUDENT: Because they think it would help their careers?

ADVISOR: Partly. But only partly. They tend to see things a little more broadly by that age, to be curious and reflective, and maybe even more

inclined to see reading novels or studying history or learning anthropology as activities that also have their own rewards. By the way, some often say it's ironic that just when their need and appetite for these other kinds of knowledge are greatest, they have the least time to do anything about it. That's another reason why it's important to get it now—at least to lay a foundation now, when you have time, for self-directed learning later on.

STUDENT: I wonder if we'll be like that—my classmates and I. Looking back and grouching...

ADVISOR: ...about your advisor, probably.

STUDENT: Not really. To tell you the truth, my only complaint would be that, after all this, I still don't have much idea how to go about selecting a good set of H&SS courses.

ADVISOR: And I have to run. So let me give you this—called “Guidelines for Selecting Courses.” It may give you some specific ideas. And, in any case, it will show you an approach to planning a good H&SS component that fits your needs and interests.

STUDENT: Thanks!

ADVISOR: You're welcome. I just want you to prepare yourself broadly—not sell yourself short. And to remember that for that you'll need the humanities and social sciences. They shouldn't be an afterthought. They're a vital part themselves of your engineering curriculum.



Today, engineers must be not only technically proficient but also skilled technology decision makers; they must grasp the complexity of social problems and the implications of their solutions. Therefore, it is imperative that future engineers be exposed to the social sciences and the humanities. Courses in these subjects will expose students to ethical and social issues, train them to make sound decisions and, most important, teach them to think critically and argue persuasively. By combining these skills with technological competence, engineers will be able to play a leadership role in solving the profound problems facing our world.

Eleanor Baum
Dean of Engineering
Cooper Union



GUIDELINES FOR SELECTING COURSES

A FIRST STEP in planning a sound H&SS component is to reflect a bit on the purposes it should serve. Realize, first, that no matter how good your math, science, and engineering courses are, they probably are not giving you, by themselves, a broad—or what colleges and universities refer to as a “general”—education.

At a minimum, all your undergraduate work taken together should provide you:

- skill in different forms of inquiry, abstract logical thinking, and critical analysis
- experience in writing, reading, speaking
- an understanding of numerical data
- historical consciousness
- a basic understanding of science
- a sense of values
- experience with the fine arts
- international and multicultural exposures

Some of these outcomes, of course, are well provided for by your science, math, and engineering courses. But for others, you will probably need to turn to your H&SS component. Your H&SS courses represent, in other words, a major part of your opportunity for general education. So whatever H&SS courses you choose, make sure they can give you the general education skills that the rest of your curriculum does not.

Your H&SS component has a second broad purpose, too. That is, it allows you to discover and explore your *own* interests and concerns. So long as you explore them through an appropriate selection of courses, these interests may be professional in nature—closely related, that is, to your particular major and career plans. On the other hand, you may decide to put together a component that has no explicit connection at all with engineering, and get to know

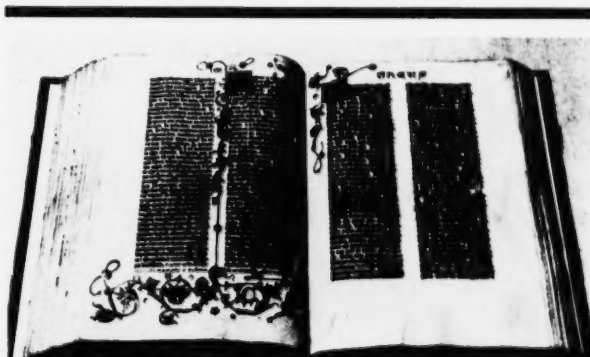
the humanities, arts, and social sciences entirely on those fields' own terms. In any case, the goal is to study what interests you—or what you think *might* interest you—in the humanities and social sciences. You don't want simply to punch your ticket. Your professors and future employers don't want you to, either.

Especially if your interests are all closely tied to engineering, it may not be clear to you just how you can make coursework in areas as apparently unrelated as H&SS meaningful. The answer has two parts. First, there really are innumerable

points at which the concerns of individual, widely offered humanities and social sciences courses connect with the field of engineering and with common interests and concerns of engineering students. So choosing single courses well—with an eye to their broad, potential relevance—is an important start.

But there is a second, additional strategy many students will find helpful. It is a strategy of *combining* H&SS courses with an overarching purpose or theme in view. You can get from the resulting "cluster" of courses a focus both broader and different than that provided by the individual offerings—a whole greater than the sum of its parts that is tailored to you. You can almost think of a good H&SS cluster as an individually designed, interdisciplinary academic minor; its combined courses will comprise a coherent, well-structured exploration of some area of interest distinct from the major, but often complementing it as well.

These points are illustrated in the sample clusters that conclude this handbook—a series of H&SS components put together by undergraduate engineering students with a range of backgrounds, needs, aspirations, and interests. Each cluster has a theme—"international" and "management" are two examples—that unites a number (though not necessarily all) of the courses within it. And although the individual



The printing of books from movable type was a technological innovation of revolutionary importance, an early harbinger of mass production

that fostered widespread literacy and speeded and democratized the transfer of knowledge. One of the earliest printed books,

the richly illuminated forty-two line Bible, was composed and printed by the Mainz goldsmith, Johann Gutenberg, in about 1455.

courses stand by themselves as broad examinations of a whole range of issues, each also provides a distinctive perspective or vantage point on the student's special topic.

Before you are too far into your program then, you will want to begin thinking about which of your developing interests or concerns or needs might provide you a worthy theme around which you can select some H&SS courses. Remember that the themes shaping the sample clusters on the following pages are only illustrations. The idea is to choose a direction that will challenge and motivate you. Your H&SS advisor should be able to help you in this. And you should feel free to seek the advice of faculty members in both engineering and the arts and sciences. If you're a first- or second-year student, you should certainly use your earliest H&SS coursework for exploration. No matter what your level, however, you can draw on everything you are thinking and learning about to identify and refine a coherent course of study in H&SS.

A few other general guidelines can help ensure the soundness of your H&SS selections. First, take enough such courses for them, as a group, to serve the broad purposes we've mentioned. Discussions on this issue sometimes get hung up on numbers—are six H&SS courses enough, or seven, or eight? Of course there's no magic number, and situations differ.

The key is to choose a theme that is substantive enough to lend itself to exploration across both the humanities and social sciences—and then be sure that you achieve some breadth and depth within it.

By *breadth* we mean work within different disciplines. Breadth introduces you to some of the different modes of thought that humanists and social scientists employ. To get at least a minimal amount of breadth, you should take at least one course each in the humanities, the social sciences, and the fine arts. And within either the humanities or the social sciences, you might want to take courses in two or more separate disciplines.

By *depth* we mean coursework at an advanced level. Depth gives you the experience of concentration in a discipline or subject area. It conveys both the possibilities and the limitations of such study. And by giving you a sense of how actually to acquire and use knowledge in a field, it can serve as a foundation for lifelong and directed learning that may be especially important to you as an engineer. You can get at least minimal depth by including in your H&SS component a series of related courses at the introductory, intermediate, and advanced levels.

Finally, look for opportunities to reflect on and integrate what you're learning. You are choosing a number of your H&SS courses because they

connect with some theme or issue. How is the group of them helping you to understand it differently? What is your work adding up to? The kind of faculty-guided "capstone" experience to look for may be offered as a senior seminar within a humanities or social sciences department, or it may be offered to engineers as a culminating interdisciplinary design project. If not, you might want to arrange your own, perhaps as a tutorial or independent study project.

To sum up, your H&SS component should:

- fulfill your institution's and program's requirements
- contribute to your general education
- allow you to explore from different vantage points some substantive issue or theme that interests you
- consist of an adequate overall number of courses representing at least the minimal number of hours prescribed by ABET
- have some breadth (ideally, at least one course each in the humanities, social sciences, and fine arts; and within either the humanities or the social sciences, at least one course in two or more different disciplines)
- have some depth (some related courses at introductory, intermediate, and advanced levels)
- include integrative and capstone experiences, in which you try to draw together what you've learned.



SAMPLE CLUSTERS

EIGHT ENGINEERING STUDENTS, with as many different sets of interests and ambitions, and at as many different schools: What courses might they select to fulfill their H&SS requirements? The sample clusters that follow provide some illustrations. These clusters also demonstrate the flexibility that is possible within the guidelines recommended here, for while all the clusters are substantive and appropriately structured, they address remarkably diverse topics.

These clusters are only illustrations. As a student, you'll need to choose the H&SS theme that's right for you. The chances are it's not one mentioned here. It may be Science, Technology, and Literature; or The History of Technology; or The Nature of Work and Profession. The possibilities are numerous.

The specific courses these students mention may not be available at your college or university. They may be offered by other names. If they are available to you, and you're interested, you'll want to investigate very carefully for coverage and quality before you decide to take them. You may well be able to pick better alternatives.

This kind of effort on your part is, in a way, the whole point of the approach this handbook advocates. Your advisor, your instructors and other faculty members, your parents, your friends—even circumstances—can help you choose your courses in H&SS. But until you get involved and take responsibility for your own learning in that area, it won't be as valuable—or as enjoyable—as it is for those who do.

H&SS CLUSTER THEME: MANAGEMENT
Sarah Chen
Junior, small private university
General Engineering major

American Literature Since 1860
World History Since 1700
Social Psychology
Industrial Relations
Microeconomics
Macroeconomics
History of Economic Thought
History of Art

I'm really interested in a career in management. Within a few years, I want to get my M.B.A. and combine that with my engineering background. One of the fields I find most attractive is venture capital. But it's too early yet to have really specific plans. I might end up in any number of areas.

The H&SS cluster I put together should help no matter what business or industry I get into. I've taken a foundation of courses that are general overviews of the culture—in literature,

history, and art. I've learned a lot in them. The history course was world history, and the history of art course gave a lot of time to non-Western traditions, too. All three—especially the American literature course—required a lot of writing. And since business or economics was to some extent a theme in most of them, there have been plenty of good topics for my papers when I didn't have other ideas.

Now I'm using the rest of my cluster for social sciences courses. Two—the course in social psychology and the one in industrial relations (taught in the sociology department)—are giving me a really good background for managing and working with people. The other three—"Microeconomics," "Macroeconomics," and "The History of Economic Thought"—are giving me some depth in that field, as well as some confidence in my ability to hold my own in an M.B.A. program.



Technologists have long had to contend with shortages of natural resources and concerns about the environment. By 1580, glassmakers operating in the forests of England—where they could find waterways to transport their materials

and the wood they needed for their furnaces—were competing with iron and copper producers and shipbuilders. Parliament considered legislation to ban the felling of trees, but by 1600, England faced an

acute timber shortage. In 1611, a new type of glass-making furnace fueled by coal was patented and was soon being used in iron- and copper-smelting as well, but this technology also brought consequences that persist to this day.

**H&S CLUSTER THEME: PUBLIC POLICY
AND THE ENVIRONMENT**

Scott Henderson

Sophomore, large state university
Civil Engineering major

History of Western Thought and Society

The Government of the United States

Problems in Social Philosophy

Historical Geography

History of Modern England

History of Art

Independent Project

I've had a hard time finding a program that fits my interests exactly—and I'm still not sure I have. They combine engineering and its impact on the environment—and the part public policy can play in the equation. Anyway, the humanities and social sciences requirement is great for me, because I'm going to use it to bring some of these things together.

I've been surprised how often even humanities courses like "History of Western Thought and Society"—required here in the freshman year—and "History of Art" get into the issues that interest me. For example, I drew on both of those courses last semester for an interdisciplinary paper on European notions of the American wilderness. The other humanities courses are ones I'm taking because I know they connect with my interests, as well as giving me breadth. "Social Philosophy" deals with the problems of arriving at decisions based both on moral convictions and the norms of a pluralistic

society. And "The History of Modern England" is in large part the story of the Industrial Revolution.

Next year I want to take "Historical Geography of the U.S." (my school has a geography department) and in political science, "The Government of the United States." Then, as a senior, I don't know. But, since I don't have many advanced courses, I may try to put together some kind of year-long independent study so I can really get into an environmental policy issue as it relates to engineering.

H&S CLUSTER THEME:

AMERICAN STUDIES

Hassan Ahmed

Junior, mid-sized private university
Petroleum Engineering major

American Studies I and II

American Literature to the Civil War

Religious Experience in America

American Political Philosophy

American Popular Culture

or Introduction to Film

When I return to my country, I will take a job in the petroleum export industry. American companies are important customers and partners for my country, and they give us much technical assistance, too. I will work with many Americans and must deal with American business practices. So one reason I am supported to study here is to improve my English, and learn about this country.

I began as a freshman with a year-long course in American studies.

That course and another, "American Literature from the Colonial Period to the Civil War," were very interesting. They showed me about the role of religion in this country. My background is very religious, too. My advisor wants me to follow this interest and take an upper-level course, "Religious Experience in America." He says that this course can help international students understand the "pluralism" of American culture. It is about such things as puritanism, the history of the black church, and "televangelism." I'm not so sure. I'm like many international students. The writing and speaking one must do in these humanities courses is very, very hard. But my advisor says they will help my English more than anything else I could do.

I am using all my free electives for business courses, so I have less time for work in the social sciences and arts. But I have taken "American Political Philosophy." Again, the writing was difficult, but the course gave me much to think about and carry home to my region, which also struggles with such ideas.

My advisor thinks sometimes I am too serious-minded. Next semester, he insists I take something in the arts—not "high culture"—something instead like "Popular Culture" or "Introduction to American Film." A course like that, he says, can be very much fun and can also give me an important view of this society.

H&SS CLUSTER THEME: ARTS
Susan Kaminski
 Junior, small private university
 Chemical Engineering major

Western Civilization

Anthropology

Ethnomusicology

History of Art

History of Music

Postmodernism: Literature, Art, Music

I don't think there is a connection between my major—chemical engineering—and what I'm doing with my H&SS requirement. Not an intentional one, anyway. I realize some engineers might want to study the arts to stoke their creative fires or think about design issues or something. And I have friends who are into applying technology in different artistic media. But I just love the arts—especially music—and always have. Doing them, thinking about them—with me, now, that's more an antidote to engineering than anything. I really enjoy engineering, too. It's just that I feel best when I can do both.

It was because of the core requirement here that I took the two semesters of "Western Civilization," but they really do give a foundation or backdrop for everything. To meet my social sciences requirement I took an introductory anthropology course. That's where I discovered a whole area called "ethnomusicology," which deals in an anthropological way with the music of other cultures. I took an

upper-level course in that last semester—but only after I chose it over another course that looked really interesting, “Aesthetics” (in the philosophy department).

I’m using the rest of my hours in H&SS for courses specifically in the arts—one course each in the history of art and the history of music and an interdepartmental offering in the art, literature, and music of Post-modernism—my favorite period. I can’t get H&SS credit for skills or performance courses, but I was even able to take piano one semester by using an elective.

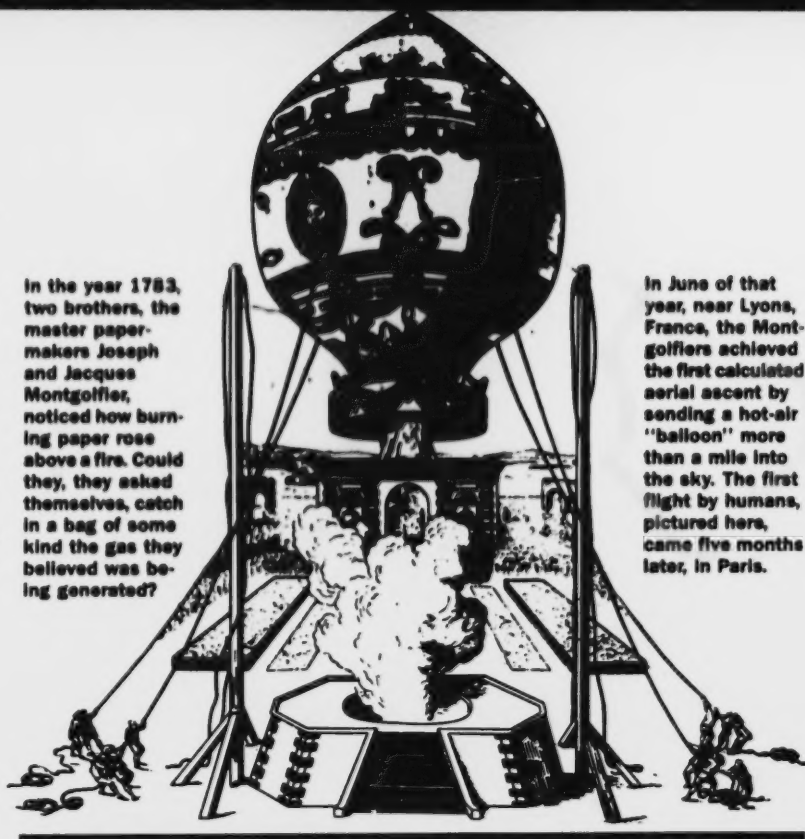
**H&SS CLUSTER THEME:
NOT YET CHOSEN**

Paul Reinhart
Freshman, large state university
Pre-engineering student

I didn’t have very good courses in subjects like English and history in high school. I’m not very interested in anything except engineering that I can think of—at least not enough to say now that I’ll take two courses in this, and three in that.

The people in the advising office say they see a lot of students like me. And fortunately, they say, since exploring is one of the things that H&SS is all about, I can put my time to good use even without a clear direction. They’ve suggested I start with a basic course—a survey, maybe—in each of three areas: the arts, the humanities, the social sciences. The actual fields might be

In the year 1783, two brothers, the master paper-makers Joseph and Jacques Montgolfier, noticed how burning paper rose above a fire. Could they, they asked themselves, catch in a bag of some kind the gas they believed was being generated?



In June of that year, near Lyons, France, the Montgolfiers achieved the first calculated aerial ascent by sending a hot-air “balloon” more than a mile into the sky. The first flight by humans, pictured here, came five months later, in Paris.

history, economics, and music history—or philosophy, art history, and political science. Anyway, I’ll do it and see if I develop a strong interest in something. If I do, great! I’ll build a sequence around that, with a couple more advanced courses. And if I don’t? Well, I’ll at least be in a position with a few more courses to finish out a well-rounded H&SS cluster. And since that will have taught me about a lot of things I don’t know much about now, I’ll know that I haven’t wasted the time.

H&SS CLUSTER THEME: GREAT IDEAS

Jeffrey Erinsohn
Junior, private technical institute
Electrical Engineering major

Old Testament

**Classical Literature and Thought
In Translation**

The Renaissance

The Enlightenment

Ideas of Classicism and Romanticism

Contemporary Theater

or Alternative Futures

or Seminar in Freud, Marx, or Darwin

My mother was upset when I decided to come here. Well, sort of, and sort of not—since they offered me a scholarship. My dad had been an engineer himself. But she was a Greek major, and we had read together and gone to museums and concerts since I was a little kid. And I really have been interested in history and culture. So she thought I should go to a liberal arts school with a strong core or even a "Great Books" program.

It turns out that technical institutes like this have their own humanities and social sciences departments. It's not always clear to me what's

humanities and what's social sciences or the arts because it's all offered in one department and the faculty like to mix things up, too. But I've been able to map out a whole H&SS program that you could call "Great Ideas." I like it. (So does my mother. She says it's the classic answer to the question, "What should every educated person know?")

Two years ago I began with a course on the Old Testament, then one in classical literature and thought in translation. Last year I took two courses, each in a key period in the development of Western thought. The first was the Renaissance. We read Shakespeare, More's *Utopia*, Machiavelli's *The Prince*. Things like that. Then the other was the Enlightenment—Mozart, Voltaire, Hogarth, Adam Smith.

I haven't had to go in chronological order, but I've done it because I've been able to and I like it that way—and I guess there is a kind of depth you get by following an idea through time. Anyway I've only had time for one course this year, "Ideas of Classi-

Lightning was a particularly deadly scourge in the Middle Ages. During one thirty-three-year period in Germany, four hundred church steeples were

struck by lightning and 120 bellringers were killed.

In a paper to the British Royal Society in 1750, Benjamin Franklin set forth his theory that there were two kinds of electricity—

positive and negative—and that a positive iron rod might attract an electrical current, sparing from damage objects that would other-

wise be in the current's path. Within just a few years, lightning conductors appeared everywhere in Europe—even on the hats and umbrellas of fashionable Parisians.

cism and Romanticism," which focused on the late eighteenth and nineteenth centuries. After three big period courses like that in a row, I'll be ready for something different as a senior. I do want something modern, but something that takes a different cut. Like a course in contemporary theater, or alternative futures—or maybe a seminar on a pivotal figure like Freud, or Marx, or Darwin.

**H&SS CLUSTER THEME: INTERNATIONAL
(JAPANESE STUDIES)**

Jennifer Lauring-Hearn
Senior, large state university
Mechanical Engineering major

**Introduction to World History
1700 to the Present**

Japanese Language (3 semesters)

**Introduction to Japanese
Culture and Civilization**

Japan's Modern Century, 1853–1952

Economics I, II

International Economics

I've been focused with my H&SS courses because I need to use the courses in specific ways. My family owns and runs a small engineering firm. It's been very successful, and it's growing fast. Its principal market has been and will probably continue to be Japan. I want to learn as much as possible about Japan's language and culture and business practices while I'm here in school, because I plan to join the company and work in Japan when I graduate.

In my freshman year, I took an in-

troduction to world history course. It's given me a frame of reference for everything else, and a foundation for the two "history and civ" kinds of courses I've taken since. The first was "Introduction to Japanese Culture and Civilization" (offered, like most of my H&SS courses, through our Institute of Asian Studies here on campus). It covers history, literature, and art. And the second was called "Japan's Modern Century, 1853–1952"—all about the country's transformation from a feudal society to a leading industrial state.

Language courses count for H&SS credit, and I've taken as much Japanese as I could squeeze in—three semesters. I've had two semesters of "Technical Japanese," as well as electives. I've mentioned six H&SS courses already—but not my Economics I and II and my course in international trade and finance. The three of those together made a really good package. I understand now all about the strong yen and balance of payments statistics—and how critical all that is to the business.

There's so much else I wish I could do—travel and internships in Japan, courses in that region's art, politics, and religion. And there's a course cross-listed between sociology and the business school on comparative management in Asia. But I remind myself that I'm getting a foundation—that's all. And I know I'll be building on it later.

**H&SS CLUSTER THEME:
COGNITIVE SCIENCE**

Antoine Harris
Junior, mid-sized public university
Electrical Engineering major

Introduction to Philosophy
History of Western Civilization
Twentieth Century American Literature
Social Psychology
Human Cognition
Sensation and Perception
History of Architecture

What interests me—and some others in EE here, too—is how computing relates to human thought: Can cognition be explained as a set of physical processes? In what ways can we take the computer as a model for the brain? What are the prospects for “artificial intelligence”? A group of us did a project last year in a cognitive psychology course, and we’ve been

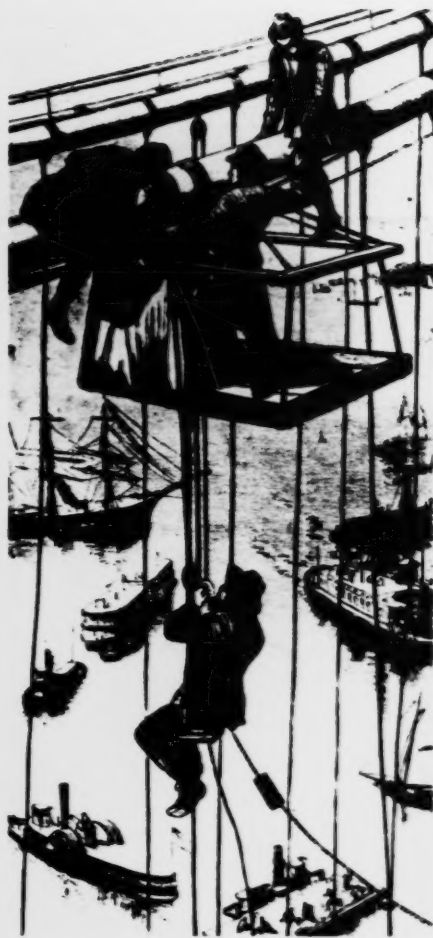
The Brooklyn Bridge, spanning New York’s East River, was built in the 1870s and early 1880s. It made spectacularly successful use of suspension techniques and materials that were newly abundant in that “Age of Steel.” Its designer, the engineer John Augustus Roebling, boasted that it would be

the greatest bridge in existence and the greatest engineering work of this continent involving, for example, four main cables containing more than fourteen thousand miles of galvanized steel wire. The device Roebling designed to spin those cables is, with improvements, still used today.

playing with these questions ever since.

There’s a core of four required H&SS courses here—“Introduction to Philosophy,” “History of Western Civilization,” an introductory course in social psychology, and a course in either nineteenth or twentieth century English or American literature. When I took “Social Psychology,” I got interested enough in the general field of psychology to want to take another course. And that, “Human Cognition,” really opened up all sorts of things for me—things I could think about in really interesting ways with my background: memory, learning, development of expertise, problem solving, reasoning, language. I’ve gone on to take a more advanced psychology course, too—“Sensation and Perception”—to get into some of this still deeper. Meanwhile it’s all tied in nicely with some work I’ve been doing with expert systems in my major and even with a paper on epistemology—the theory of knowledge—in my philosophy class.

A friend of mine who has the same interests has taken a linguistics course and tells me I should take it, too, to finish my H&SS requirements. I don’t know, though—I’m thinking now I would like to know something about the history of architecture. I’d say it doesn’t have a thing to do with anything else I’ve taken. But I’d be an odd one to say that, given some of the connections I’ve come across already.



ACKNOWLEDGMENTS

FUNDING Andrew W. Mellon Foundation

**PROJECT
ADVISORY
COMMITTEE**

Joseph Bordogna, University of Pennsylvania
Edmund T. Cranch, University System of New Hampshire
Samuel C. Florman, Kreiser Borg Florman Construction Company
O. Allan Gianinny, Jr., University of Virginia
Margaret L. MacVicar, Massachusetts Institute of Technology
William F. Prokasy, University of Illinois at Urbana-Champaign
David Reyes-Guerra, Accreditation Board for Engineering and Technology
Linda B. Salamon, Washington University
J. David Waugh, University of South Carolina

**WORKING GROUPS
OF ENGINEERING
AND LIBERAL ARTS
EDUCATORS**

Tad Beckman, Harvey Mudd College
Melvin Chernov, University of Virginia
O. Allan Gianniny, Jr., University of Virginia
Robert Kellogg, University of Virginia
Edmund T. Cranch, University System of New Hampshire
Edward Daub, University of Wisconsin
Richard Devon, Pennsylvania State University
William Grogan, Worcester Polytechnic Institute
Richard Jacobs, California State Polytechnic University-Pomona
Mark Levinson, University of Maine
W. David Lewis, Auburn University
Judith Liebman, University of Illinois at Urbana-Champaign
William F. Prokasy, University of Illinois at Urbana-Champaign
Ernest Lynton, University of Massachusetts-Boston
Luz Martinez-Miranda, University of Pennsylvania
David Pope, University of Pennsylvania
Susan Resneck Parr, University of Tulsa
Y. T. Shah, University of Tulsa
Thomas Phelan, Rensselaer Polytechnic Institute
Thomas Philipose, Colorado School of Mines
David Reyes-Guerra, Accreditation Board for Engineering and Technology
Linda B. Salamon, Washington University
James Schaub, University of Florida
Lambert Van Poolen, Calvin College

CONSULTANTS

Lance Schachterle, Worcester Polytechnic Institute
Tad Beckman, Harvey Mudd College
Susan Resneck Parr, University of Tulsa
Lambert Van Poolen, Calvin College
Linda Weiner

**ADDITIONAL
THANKS TO**

The Pennsylvania State University Advising Center;
Kenneth Busby and Anna White, University of Tulsa;
Richard Devon, Pennsylvania State University;
Jane Spalding, Shelagh Casey, Nora Topalian,
Sherry Levy-Reiner, Luran Nohe, Karen Foremski,
John Chaffin, Matthew Anderson, and David Stearman
of AAC.

—JOSEPH S. JOHNSTON, JR., DIRECTOR OF PROGRAMS, ASSOCIATION OF AMERICAN COLLEGES



1215 R Street, N.W.
Washington, D.C. 20004

The Association of American Colleges, founded in 1915, is the national voice for liberal learning. Its membership includes more than 610 public and private colleges and universities. Through grants, publications, and workshops, AAC strives to enhance liberal education and secure its integration with professional programs and courses of study. It includes the Project on the Status and Education of Women.